AMENDMENTS TO THE CLAIMS:

The listing of claims replaces all prior versions and listings of claims in the application:

LISTING OF THE CLAIMS

1.   (Currently Amended) An intelligent ink cartridge comprising:

at least ~~an~~ one ink chamber for storing ~~ink,~~ ink therein;

an electronics module ~~which can~~ adapted to store identification information data of the ink cartridge and ink remaining data, wherein,

the electronics module is a micro-controller with embedded non-volatile ~~memory,~~ ~~and the micro-controller is used to control calculation and~~ memory storing a program executable to control access and processing of ink remaining data in the ink cartridge to improve the maximum of ink volume of the ink cartridge.

2.   (Original) An intelligent ink cartridge according to claim 1, wherein said non-volatile memory is an EEPROM.

3.   (Currently Amended) An intelligent ink cartridge according to claim 1, wherein said micro-controller is [[a]] an 8-bit CMOS RISC ~~8-bit~~ micro-controller ~~of CMOS or a micro-controller with higher capability~~.

4.   (Currently Amended) An intelligent ink cartridge according to ~~any one of claims 1, 2 and 3,~~ claim 1 wherein said micro-controller ~~comprises:~~ includes:

an ALU (arithmetic and logic unit) connected ~~to~~ with a data ~~bus,~~ bus;

an EEPROM memory for storing said identification information data of the ink cartridge and said ink remaining data,

plural registers,

<u>an</u> interrupt unit,

<u>a</u> serial periphery interface unit,

<u>a</u> timer,

<u>an</u> analog comparator,

<u>an</u> I/O interface, and

a ~~fast flash (or ROM, or other form of program memory)~~ <u>program memory</u> connected to said ALU by said register for storing a program controlling reading and writing operations and calculation of ink remaining data.

5.   (Currently Amended) An intelligent ink cartridge according to claim 4, further comprising a R-C control circuit ~~with~~ <u>defining a preselected</u> time constant ~~of appropriate~~ value, used to distinguish ~~the~~ <u>a</u> checking read cycle <u>of said cartridge</u> and ~~the~~ <u>a</u> normal read cycle <u>of said cartridge</u>, wherein, said R-C control circuit is connected to the input interface of said micro-controller.

6.   (Currently Amended) A method of manufacturing an intelligent ink ~~cartridge, which comprises at least one ink chamber for storing ink, and an electronics module storing identification information of ink cartridge and ink remaining data,~~ <u>cartridge of the type including at least one ink cartridge for storing ink therein; and</u> an <u>electronics module adapted to store identification information data of the ink cartridge and ink remaining data, wherein, the electronics module is a micro-controller with embedded non-volatile memory storing a program executable to control access and processing of ink remaining data in the ink cartridge to improve the maximum of usable ink volume of the ink cartridge, the method</u> comprising:

~~to set~~ disposing a ~~special-purpose~~ micro-controller ~~in~~ on the ink cartridge;

~~to write~~ writing i) identification information of the ink cartridge and ~~the~~ ii) a program controlling access and process operations of ink remaining data into the non-volatile memory of the ~~special-purpose~~ micro-controller; and,

~~to carry out the~~ executing said program so that it can meet the requirement of control and reading and writing operations of ink remaining data by an associated ink jet apparatus when ink capacity of ink cartridge is increased.

7.   (Currently Amended)   A method of manufacturing an intelligent ink cartridge according to claim 6, wherein, said identification information of the ink cartridge and said ink remaining data is stored into an EEPROM memory in the ~~special-purpose~~ micro-controller, and said program for controlling access and process operation of ink remaining data is stored into a fast flash memory in said micro-controller.

8.   (Currently Amended)   A method of manufacturing an intelligent ink cartridge according to claim 7, wherein, said program ~~can carry out the steps as follow~~ is adapted to execute the steps of:

~~to transfer~~ transferring an ink utilization percentage stored in EEPROM to register temp1 in said micro-controller during printer power on or when the ink cartridge is installed on the associated ink jet apparatus and moved to normal position;

~~to transfer~~ transferring said ink utilization percentage into said ink jet apparatus from said register temp1 when a control signal of the associated ink jet apparatus is received;

~~to update~~ updating the ink utilization percentage at the ~~printing~~ associated ink jet apparatus during printing;

~~to store~~ storing the updated ink utilization percentage written into the ink cartridge from the associated ink jet apparatus into the register temp2 in said micro-controller during printer power off or when the ink cartridge is moved to installation ~~position~~ position;.

~~to further carry out the following~~ executing steps in said ~~micro-controller~~ micro-controller of:,

temp3=temp2=temp1;

temp3-temp3/(1+x%), wherein, x% is the targeted increment in ink capacity of said ink cartridge;

temp1=temp1+temp3; and,

~~to store~~ storing ink utilization percentage updated to EEPROM from said register temp1 and ~~use~~ using it as the output from cartridge to the associated ink jet apparatus for the next printer power on read cycle.

9.   (Currently Amended)   A method of manufacturing an intelligent ink cartridge according to claim 7 ~~or 8,~~ further comprising a check step for checking whether updated ink utilization percentage is larger than predetermined value y, and ~~adjust~~ adjusting the ink utilization percentage if no previous adjustments had been performed ~~before,~~ wherein x% is the targeted increment in ink capacity and a% is the additional consumption due to ~~the~~ an additional head cleaning operation, so as to check whether ink utilization has been adjusted when ink utilization percentage is higher than (x+a)% and the ink utilization is updated, wherein, adj=0 means ink utilization has been not adjusted and adj=1 means ~~it~~ ink utilization has been done.

10.   (Currently Amended)   A method of manufacturing an intelligent ink cartridge according to claim 9, wherein, the check step for checking whether said micro-controller has adjusted ink utilization percentage of a new ink cartridge ~~comprises:~~ includes:

~~to set~~ setting an initial status flag into EEPROM of a new ink ~~cartridge, at step 1~~ cartridge;

~~to read and judge~~ reading and judging said status ~~flag, at step 2~~ flag; and,

~~to subtract~~ subtracting (x+a) from the updated ink utilization percentage before storage to EEPROM should the status flag has been not adjusted and updated ink utilization percentage be higher than (x+a)%, and change the flag to signify ink utilization percentage had been ~~adjusted, at step 3~~ adjusted.

11.   (Currently Amended)   A method of manufacturing an intelligent ink cartridge according to claim 9, further ~~comprising another~~ including an additional check step for distinguishing ~~the~~ a first read cycle ~~that~~ immediately ~~follows~~ following a write cycle during printer power off ~~and the~~ from a second read cycle performed during printer power on.

12.   (Currently Amended)   A method of manufacturing an intelligent ink cartridge according to claim 6 ~~or 7, wherein,~~ further including:

providing an R-C circuit with a time constant of appropriate value ~~is connected to~~ with an input port of said micro-controller for distinguishing a checking read cycle ~~and~~ from a normal read cycle.

13.   (Currently Amended) An electronics module of an intelligent ink cartridge for use with an associated ink jet printer apparatus, <u>the electronics module</u> storing identification information of the ink cartridge and ink remaining data, wherein, the electronics module is a micro-controller with embedded non-volatile memory ~~and the micro-controller is used to control calculation and~~ <u>storing a program executable to control</u> access <u>and process</u> operations of <u>said</u> ink remaining <u>data</u> in the ink cartridge ~~to improve~~ <u>for improving</u> the maximum ink capacity <u>utilization</u> of the ink cartridge ~~for use with the ink jet apparatus~~.

14.   (Currently Amended) An electronics module according to claim 13, wherein, said non-volatile memory in said micro-controller stores ~~identificationinformation~~ <u>said identification information</u> of said ink cartridge and the program for controlling access and process operations of ink remaining data <u>is stored in a one of a flash memory and a ROM memory</u>, so as to ~~still~~ meet the requirement of controlling and reading/writing ink remaining data by said ink jet apparatus when said program is carried out and ink capacity of said ink cartridge is improved.

15.   (New) An ink cartridge apparatus for use with an associated printing device, the ink cartridge apparatus comprising:

a housing holding ink therein;

a micro-controller having a memory storing ink remaining data indicating a relative amount of ink remaining in the cartridge apparatus; and,

a computer program, performed by the micro-controller for, in response to receiving signals from the associated printing device, manipulating said ink remaining data for increasing a utilization of ink from the ink cartridge apparatus.

16.   (New) The ink cartridge apparatus according to claim 15 wherein said computer program is executable by said micro-controller for manipulating said ink remaining data for increasing said utilization of ink from the ink cartridge apparatus by:

transferring ink utilization percentage data stored in a register temp1 in said micro-controller i) during a power on cycle of said associated printing device and ii) when the ink cartridge apparatus is installed on the associated printing device and moved to a normal position;

transferring the ink utilization percentage data into the associated printing device from register temp1 in response to a control signal received from the associated printing device is received;

updating the ink utilization percentage data after a printing operation;

storing the ink utilization percentage data written into the ink cartridge apparatus from the associated printing device into a register temp2 in said micro-controller during a power off of said associated printing device or when said ink cartridge apparatus is moved to an installation position relative to said associated printing device;

subtracting the previously stored ink utilization percentage data in register temp1 from the updated ink utilization percentage data in register temp2 and storing the result of said subtracting into a register temp3;

dividing a value temp3=temp2-temp1 obtained in the subtracting step by a divisor (1+x%) to generate a quotient value and storing the quotient value in register temp3;

adding the quotient value in register temp3 obtained in said dividing step to said previously stored ink utilization percentage data in register temp1 as temp1=temp3+temp1;

storing the value in register temp1 in a memory of said micro-controller; and,

using the value temp1 stored in said register as an output from said ink cartridge apparatus to said associated printing device during a subsequent power on read cycle of said associated printing device.

17.   (New) The ink cartridge apparatus according to claim 16 wherein said micro-controller is a reduced instruction set controller (RISC) and said computer program is stored in a memory of the micro-controller.

18.   (New) The ink cartridge apparatus according to claim 15 wherein said computer program is executable by said microcontroller for manipulating said ink remaining data for increasing said utilization of ink from the ink cartridge apparatus by:

using a software flag (adj) stored in a memory of said micro-controller on said ink cartridge apparatus to signify whether said ink utilization data had been adjusted by the micro-controller using an initial logical value of "0" to signify an unadjusted state;

transferring said ink utilization data stored in said memory to a register reg1 when receiving a power signal from said associated printing device or when mounting said ink cartridge apparatus during a power on cycle of said associated printing device;

sending said ink utilization data to said associated printing device from reg1 under control of said associated printing device upon a power on cycle of said associated printing device;

permitting a printing operation by said associated printing device;

storing said updated ink utilization data written to said ink cartridge apparatus into register reg1 during a power off cycle of said associated printing device or during a removal of the ink cartridge apparatus from the associated printing device;

transferring, when the value stored in register reg1 is less than a predetermined value y and the logical value of the flag adj is "0", the updated ink utilization percentage data as stored in register reg1 into a predetermined memory location in said micro-controller during a power off cycle of said associated printing device; and,

subtracting, when the logical value stored in register reg1 is less than said predetermined value y and said logical value of the flag adj is "0", (x+a) from register reg1 and storing the result back to register reg1, where x% is a targeted increment in ink capacity and a% is an additional consumption due to additional head cleaning operations performed by said associated printing device.

19.   (New) The ink cartridge apparatus according to claim 18 wherein said micro-controller is a reduced instruction set controller (RISC) and said computer program is stored in a memory of the micro-controller.

20.   (New) The ink cartridge apparatus according to claim 15 wherein said computer program is executable by said micro-controller for manipulating said ink remaining data for increasing said utilization of ink from the ink cartridge apparatus by:

using a software flag (adj) stored in a memory location in said micro-controller to signify whether said ink utilization data had been adjusted by the micro-controller with an initial logical value of "0" to signify an unadjusted state;

transferring the updated ink utilization data stored in said memory location of said micro-controller to a register reg1 upon a power on cycle of said associated printing device or upon an installation of said ink cartridge onto said associated printing device;

sending said ink utilization percentage data in register reg1 to said associated printing device upon a power on cycle of said printing device when a one of: i) an external signal TP1 is received by said micro-controller indicating a normal read cycle logic level TP1=0, ii) when a value stored in register reg1 is less than a predetermined value y, and iii) when said ink utilization percentage data had been modified as determined based on the value of the software flag adj being a logic level 1 value;

subtracting (x+a) from register reg1 and storing the result in register reg1 when i) said software flag adj has a logic value of "0", ii) the value stored in register reg1 is greater than said predetermined value y, and iii) the external signal TP1 received indicates a checking read cycle logic level TP1=I and changing said software flag adj to a logic level of "1" and sending the value in reg1 to the associated printing device upon a power on cycle where x% is a targeted increment in ink capacity and a% is an additional consumption due to an additional head cleaning operation in said associated printing device;

permitting a printing operation in said associated printing device;

storing the updating ink utilization percentage data written to said micro-controller from said associated printing device to register reg1 upon a power off cycle of said associated printing device or upon a moving of said ink cartridge apparatus to an installation position for removal relative to said associated printing device; and,

updating the ink utilization percentage data stored in a memory of said micro-controller with the value stored in register reg1.

21.   (New) The ink cartridge apparatus according to claim 20 wherein said micro-controller is a reduced instruction set controller (RISC) and said computer program is stored in a memory of the micro-controller.